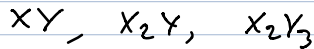


March 29, 2018

Today: Lewis structures.



Q: Is it a ionic compound or molecular compound?

- Electronegativity (EN): ability to attract an electron
- DEN (difference in EN of two elements): nature of the bond



ionic: metal and non metal (NaCl) : full transfer

covalent: non-metal and non-metal : sharing

- Why forms bond:

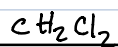
- ① Achieve noble gas configuration
↳ Octet rule \rightarrow 8 e^- in valence shell
- ② Be more stable.

Depending on the compound \rightarrow Lewis diagram or Lewis structure
ionic molecular

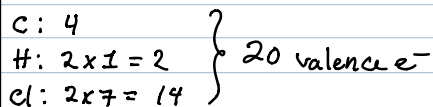
Today: Molecular compounds

- ① Covalent bonds (sharing)
- ② Most will obey octet rule
- ③ Some have less than 8 e^- in valence shell (incomplete octet)
↳ Be and B, Al
- ④ Some have more than 8 valence e^- (expanded octet)
↳ atoms have an empty d orbital (elements in period 3 and up)

Lewis structure



Step 1

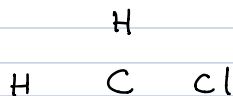
Find total # of valence e^- .

Step 2

2.1: Central atoms (least EN)
↳ except H.

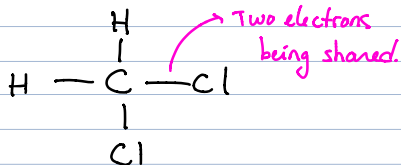
C

2.2: All other atoms: Surrounding
central atom

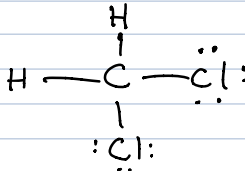


Cl

2.3: Draw a line between
surrounding and central
atoms



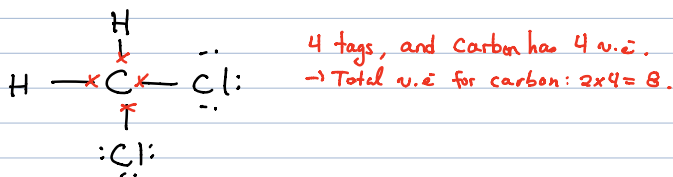
Step 3: Satisfy octet rule for
surrounding atoms



Step 4: Add remaining e^- to central
atom

$$20 - 20 = 0$$

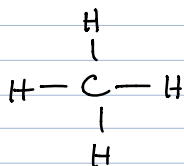
Step 5: Verification step



a) CH_4

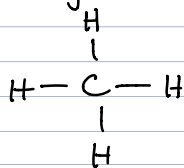
① Total v.e⁻ : 8

② Skeleton

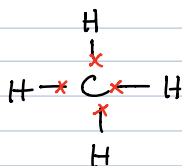


③ Each H has 2 v.e⁻.

④ Remaining v.e⁻ : $8 - 8 = 0$



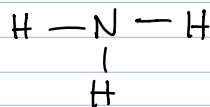
⑤ Tag v.e⁻ of central atom



b) NH_3

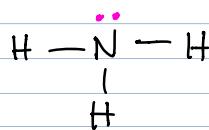
① Total v.e⁻ : 8

② Skeleton

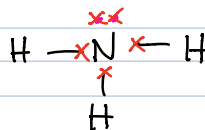


③ Each H has 2 v.e⁻.

④ Remaining v.e⁻ : $8 - 6 = 2$

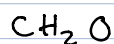


⑤ Tag v.e⁻ of central

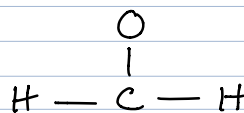


Multiple bond

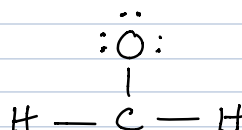
Step 1 Total # of v.e : 12



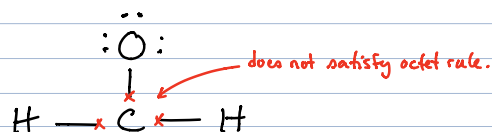
Step 2: Build skeleton of Lewis structure



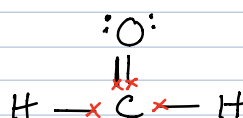
Step 3: Satisfy octet for surrounding atoms



Step 4: $\# \text{ v.e} = 12 - 12 = 0$



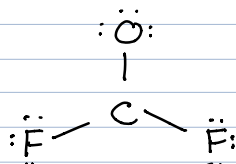
* include a double bond $\text{C}=\text{O}$.



a) COF_2

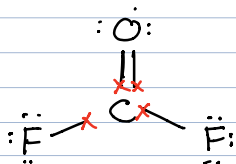
① Total: $4 + 6 + 2 \times 7 = 24$

② Skeleton + ③ Satisfy octet of surrounding



④ Total v.e. left: $24 - 24 = 0$

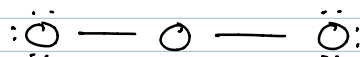
⑤



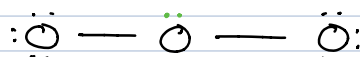
b) O_3

① Total v.e = 18

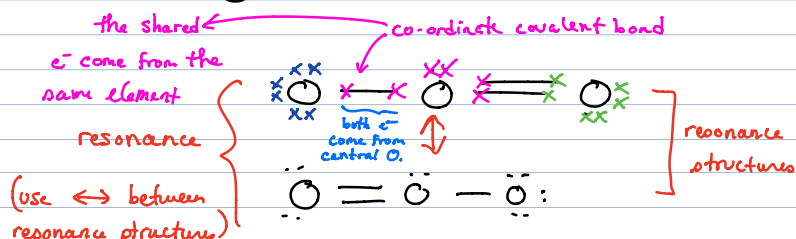
② Skeleton + ③ Satisfy octet of surrounding



④ remaining v.e.: $18 - 16 = 2$

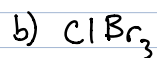
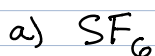


⑤



Extend octet

* Elements in period 3 and up can have an extended octet (> 8 v.e.).

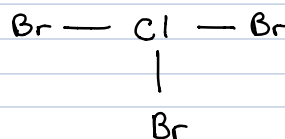
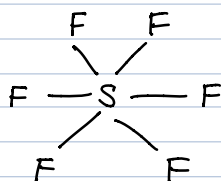


① Total # of v.e.: 48

① Total # of v.e.: 28

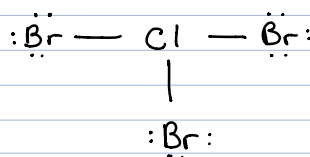
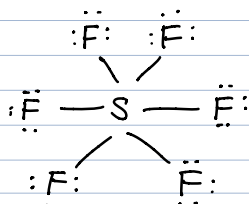
② Skeleton of Lewis structure

② Skeleton of Lewis structure



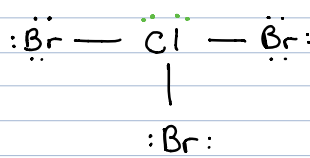
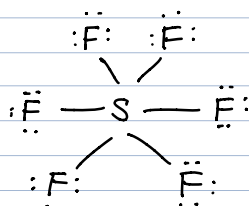
③ Have surrounding atoms satisfy octet rule

③ Have surrounding atoms satisfy octet rule



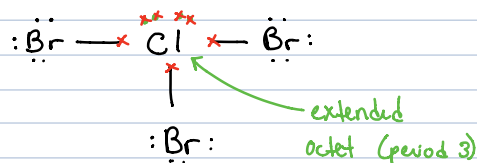
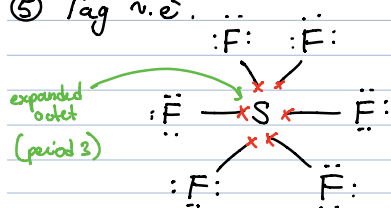
④ # v.e. left = $48 - 48 = 0$.

④ # v.e. left = $28 - 24 = 4$



⑤ Tag v.e.

⑤ Tag v.e.



ok, # of x matches the # of v.e. of S (6), but there are a total 2×6 bonds = 12 v.e. (more than 8)

ok, # of x matches the # of v.e. of Cl (7), but there are a total of 2×3 bonds + 2×2 lone pairs = 10 v.e. (more than 8)